

# **RTE Driver DVR23 For HP 7970 Series Digital Magnetic Tape Units**

# PRINTING HISTORY

The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, Update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past Updates, however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all Updates.

To determine what manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

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## SECTION I

### GENERAL INFORMATION

#### 1-1. GENERAL DESCRIPTION

1-2. This manual contains information and procedures that will allow the user to write application programs using FORTRAN or Assembly language and RTE Driver DVR23. Section III provides information required when configuring DVR23 into a Real-Time Executive (RTE) Operating System. The driver is entered through a FORTRAN or Assembly language call to control one to four HP 7970 Series 9-track Digital Magnetic Tape Units (via a HP 13181A or HP 13183A Magnetic Tape Unit Interface Kit) in a Real-Time Executive Operating System environment. The interface provides all tape motion and data transfer control signals required for generating IBM-compatible nine-track formats. The multispeed capability of the interface kit permits interfacing with tape units operating at 12.5, 37.5, or 45 inches per second with a packing density of 800 or 1600 characters per inch. (Commonly-controlled paralleled tape units must be at the same tape speeds.)

1-3. The interface kit requires two computer I/O addresses: a command channel address and a data channel address. The data channel is assigned the higher priority I/O address. DMA is required for all tape speed configurations.

#### 1-4. OPERATING ENVIRONMENT

1-5. The operating environment for this software must be a HP 2100 Series Computer, an RTE Operating System, and the interface kit hardware. Refer to the HP 13181A or HP 13183A Digital Magnetic Tape Unit Interface Kit Operating and Service Manual (HP Part No. 13181-90000 or 13183-90000) for interface kit hardware details.

#### 1-6. COMPONENTS

1-7. The following components are included with Driver DVR23:

- a. This manual.
- b. Driver DVR23 binary tape, HP Part No. 92202-16001.



## SECTION II

### APPLICATION INFORMATION

#### 2-1. GENERAL

2-2. This section details the calls to the driver and describes any results of the hardware/software marriage where the hardware may influence software techniques.

2-3. Before writing programs using the driver, it is recommended that the user consult Section III of the interface kit operating and service manual. This provides instructions on how to operate the tape unit, including a description of controller commands, status information, and typical Assembly language operating programs.

#### 2-4. CALLING SEQUENCES

2-5. The HP 7970 Series Magnetic Tape Unit is operated in the Real-Time Executive System through FORTRAN/Assembly language programs calling DVR23. The driver will cause the magnetic tape unit to respond to Read, Write, Control and Status requests using the standard calls to EXEC. These calls are listed in Tables 2-1 through 2-3.

#### 2-6. STATUS REQUEST

2-7. Information returned from a status request is detailed in Table 2-4. It should be noted that:

a. A rewind backspace record or backspace file request will perform no action if the tape unit is at load point. The start-of-tape condition will be reflected both before and after the request is made in the status word.

b. Forwardspace File and Backspace File commands cause the tape unit to go forward or backward until a file mark has been detected. Data is not transferred, but parity is checked. A parity error in any record of the file will set the parity error status bit. A backspace file will position the tape in front of a file mark or at load point whichever comes first.

c. If the end-of-tape mark is sensed during the execution of a forwardspace file function, the tape will stop at the end of the current record rather than after a file mark. The user must check for this condition with a status request.

Table 2-1. HP 7970 Read/Write Calls (DVR23)

Assembly Language	
<pre> EXT EXEC . . JSB EXEC DEF *+5 DEF ICODE DEF ICNWD DEF IBUFR DEF IBUFL &lt;return point&gt; . . </pre>	<p>Where:</p> <p>ICODE = Function Code  1 = Read request  2 = Write request</p> <p>ICNWD = Control Word  Bits 0 } = Logical unit number of tape unit  thru 5 }  Bit 6 = Type of data  Only used when a zero length read occurs as indicated below.  0 = ASCII read/write  1 = binary read/write</p> <p>All other }  Bits } = Set to 0</p> <p>IBUFR = Address of first word of input/output buffer</p> <p>IBUFL = Input/output buffer length in either characters or words. A negative value indicates ASCII characters (two per word); a positive value indicates words.  A length of zero on output causes immediate completion of the request.  On input, only as much data as will fit within specified buffer length is transmitted.  A zero length buffer size on Binary Read causes a forward skip of one record.  A zero length buffer size on ASCII Read causes immediate completion of the request.  The minimum length of a Read/Write operation for tape unit is one word (two characters).  The tape unit does not write an odd number of characters; driver will "pad" input buffer if an odd number of characters is read.</p> <p>On Return:</p> <p>A = Status (See Table 2-4).</p> <p>B = Transmission Log - The positive number of words or characters transmitted on all reads and unbuffered writes. Units will be words if IBUFL is positive and characters if IBUFL is negative.</p>
FORTRAN	CALL EXEC (ICODE,ICNWD,IBUFR,IBUFL)



Table 2-2. HP 7970 Control Request Calls (DVR23)

Assembly Language	<p>Where:</p> <p>ICODE = Function Code 3 = Control request</p> <p>ICNWD = Control Word</p> <p>Bits 0 } = Logical unit number thru 5 } of tape unit</p> <p>Bits 6 } = Function code thru 10 }</p> <p>01 = Write End-of-File 02 = Backspace 1 record 03 = Forwardspace 1 record 04 = Rewind 05 = Rewind/Standby 06 = Dynamic Status 12 = Erase 4 inches of tape 13 = Forward space file 14 = Backspace file</p> <p>All un-used Bits } = Set to 0</p> <p>On Return:</p> <p>A = Status (See Table 2-4). For a buffered device the status will not be affected, but will remain the same value as before the request was made.</p> <p>B = No meaning.</p> <p>NOTE</p> <p>Motion requests (codes 02 thru 05 and 12 thru 14) set the transmission log to zero. When a rewind is requested, control is returned to the caller after a rewind is indicated (before rewind is completed).</p> <p>Dynamic Status request 06 is never buffered by the system. Therefore, the status returned by this call is always a post operation status.</p>
<pre> EXT EXEC . . JSB EXEC DEF *+3 DEF ICODE DEF ICNWD &lt;return point&gt; . . </pre>	<p>FORTRAN      CALL EXEC (3,ICNWD)</p>

Table 2-3. HP 7970 Status Request Call (DVR23)

Assembly Language	Where:
EXT EXEC . . JSB EXEC DEF *+4 (or 5) DEF ICODE DEF ICNWD DEF ISTA1 DEF ISTA2(optional) <return point> . .	ICODE = Function Code 13 = Status Request  ICNWD = Control Word Bits 0 } = Logical unit number thru 5 } of tape unit All other } = not used Bits  ISTA1 = Word 5 of Equipment Table (EQT) Tape Unit Status flags. See Table 2-4 for format.  ISTA2 = Word 4 of EQT. See Table 2-5 for format.
FORTRAN	CALL EXEC (13,ICNWD,ISTA1,ISTA2[optional])

Table 2-4. Status Return Information (ISTAl)

Bits	Function																		
14 and 15	<p>Tape unit availability code</p> <p>0 = Unit available for use (not busy)  1 = Unit disabled  2 = Unit currently in operation (busy)  3 = Unit waiting for an available DMA channel</p>																		
13 - 8	<p>Equipment code</p> <p>Always = 23 octal</p>																		
7 - 0	<p>Status flags. Meaning when in (1 = on, 0 = off)</p> <table> <tr> <th><u>Bit</u></th><th><u>Status</u></th></tr> <tr> <td>7</td><td>End-of-file record encountered when reading, forward spacing, or backward spacing</td></tr> <tr> <td>6</td><td>Start-of-tape marker sensed</td></tr> <tr> <td>5</td><td>End-of-tape marker sensed</td></tr> <tr> <td>4</td><td>Timing error on last read/write operation</td></tr> <tr> <td>3</td><td>I/O request rejected: <ul style="list-style-type: none"> <li>a. Tape motion required, but tape is at load point</li> <li>b. Backward tape motion required, but tape is at load point</li> <li>c. Write Request was given, but reel does not have a Write enable ring.</li> </ul> </td></tr> <tr> <td>2</td><td>Reel does not have a Write enable ring</td></tr> <tr> <td>1</td><td>Parity and/or timing error</td></tr> <tr> <td>0</td><td>Tape unit not on-line</td></tr> </table> <p>NOTE: Bit 0 can be ignored by user.</p>	<u>Bit</u>	<u>Status</u>	7	End-of-file record encountered when reading, forward spacing, or backward spacing	6	Start-of-tape marker sensed	5	End-of-tape marker sensed	4	Timing error on last read/write operation	3	I/O request rejected: <ul style="list-style-type: none"> <li>a. Tape motion required, but tape is at load point</li> <li>b. Backward tape motion required, but tape is at load point</li> <li>c. Write Request was given, but reel does not have a Write enable ring.</li> </ul>	2	Reel does not have a Write enable ring	1	Parity and/or timing error	0	Tape unit not on-line
<u>Bit</u>	<u>Status</u>																		
7	End-of-file record encountered when reading, forward spacing, or backward spacing																		
6	Start-of-tape marker sensed																		
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2	Reel does not have a Write enable ring																		
1	Parity and/or timing error																		
0	Tape unit not on-line																		

Table 2-5. Status Return Information (ISTA2)

WORD	CONTENTS															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EQT 4	D	B	P	S	T	Unit #					Channel #					
ISTA2	D	= 1 if DMA required.														
	B	= 1 if automatic output buffering used.														
	P	= 1 if driver is to process power fail.														
	S	= 1 if driver is to process time-out.														
	T	= 1 if device timed out (system sets to zero before each I/O request).														
	Unit	= Last sub-channel addressed.														
	Channel	= I/O select code for device (lower number if a multi-board interface).														

2-8. ERROR RECOVERY PROCEDURES

## 2-9. READ PARITY ERROR

2-10. The driver will re-read a given record up to ten times before declaring the parity error to be irrecoverable. After the tenth attempt, the last try will be transmitted to the user buffer and a nominal return taken. The status will indicate the parity error; the user must check for this condition. The operating system prints:

I/O ERR PE EQT #n

where "n" is the equipment table entry number.

## 2-11. WRITE PARITY ERROR

2-12. The driver will continue to retry writing a given record until one of two conditions is met:

- a. The record is successfully written.
- b. The end-of-tape (EOT) is encountered.
- c. 34 attempts have been made.

## 2-13. EQUIPMENT NOT READY

2-14. The tape unit will stop if a write is made and no write ring is provided or if a tape motion request is made when the tape unit is off-line. The operating system prints:

I/O ERR NR EQT #n

where "n" is the equipment table entry number.

## 2-15. ATTEMPTED WRITE AT END-OF-TAPE (EOT)

2-16. The drive will allow 1 additional forward motion request made after an EOT condition is encountered.

2-17. There are only two "legal" forward motion requests after EOT:

- a. Write end-of-file (EOF) mark.
- b. Read record.

2-18. A second forward motion request after EOT is sensed will put the magnetic tape unit down. This is to ensure that the user rewinds the magnetic tape, inserts a new reel and ups the units.

2-19. Backward motion requests (rewind and backspace record and backspace file) will reinstate the EOT situation to the way it was upon first encountering EOT.

2-20. LIMITED LENGTH RECORDS

2-21. The minimum record length is one word. The maximum record length is dependent on DMA operation and available memory. Only the length specified in the request will actually be transmitted from or to the user buffer.

2-22. DYNAMIC STATUS

2-23. The dynamic status request has been provided so that the actual status of the tape unit can be determined while I/O operations are being performed. Because this type of status request goes all the way to the driver for its operation, it may take slightly longer than the normal status request. The status word, is returned in the A-Register to the user. This request will not be processed until the MT EQT entry is not busy. The EOT entry is updated by this request.

## SECTION III

### CONFIGURATION INFORMATION

#### 3-1. GENERAL

3-2. This section provides configuration information for Driver DVR23 and is intended to augment the data provided in the Real-Time Executive Software System Programming and Operating Manuals.

Note that DVR23 drives either an 800 BPI or a 1600 BPI 9-track magnetic tape.

#### 3-3. REAL-TIME GENERATION

3-4. The driver is loaded into the RTE system during system generation. At this time, the following items must be supplied by the operator to configure the tape unit into the RTE system being generated:

#### 3-5. PROGRAM INPUT PHASE

3-6. Driver DVR23 must be relocated during this phase.

#### 3-7. TABLE GENERATION PHASE

3-8. In this phase, the following three entries must be made:

- a. An Equipment Table entry for each HP 13181A or HP 13183A Interface card:

- \* EQUIPMENT TABLE ENTRY

- .  
.  
nn,DVR23,B,T=500

- .  
.  
where "nn" is the lower-numbered select code of the HP 13181A or HP 13183A Interface Card, and "B" and "T=500" represent suggested buffering and time-out options.

- b. A Device Reference Table entry for each HP 13181A or HP 13183A Interface card:

- \*DEVICE REFERENCE TABLE

- .  
.  
n = EQT#?  
m  
.  
.

where "n" is the logical unit number assigned to the subsystem. Response "m" is a number that corresponds to the "nn", DVR23 position in the Equipment Table.

c. An Interrupt Table entry for each HP 13181A or HP 13183A card:

\* INTERRUPT TABLE

```
.
.
nn, EQT, m
nn+1, EQT, m
.
```

where "nn" is again the lower-numbered select code of the HP 13181A or HP 13183A Card, "nn"+1 is the higher-numbered select code of the card, and "m" is again the position of the subsystem in the Equipment Table.

Below is an example of the entries that could be made for the three tables discussed above.

Equipment Table:

```
EQT 01?
12,DVR32,D
EQT 02?
11,DVR00,B
EQT 03?
13,DVR23,B,T=500
.
.
.
```

Device Reference Table:

```
1 = EQT#?
2
2 = EQT#?
1
3 = EQT#?
0
4 = EQT#?
3
.
.
.
```

Interrupt Table:

```
-
11,EQT,2
-
12,EQT,1
-
13,EQT,3
-
14,EQT,3
-
.
.
```



## READER COMMENT SHEET

RTE DRIVER DVR23 For  
HP 7970 Series Digital  
Magnetic Tape Units

92202-93001

October 1981

Update No. \_\_\_\_\_  
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